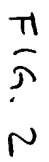


Fig. 1

[illegible]

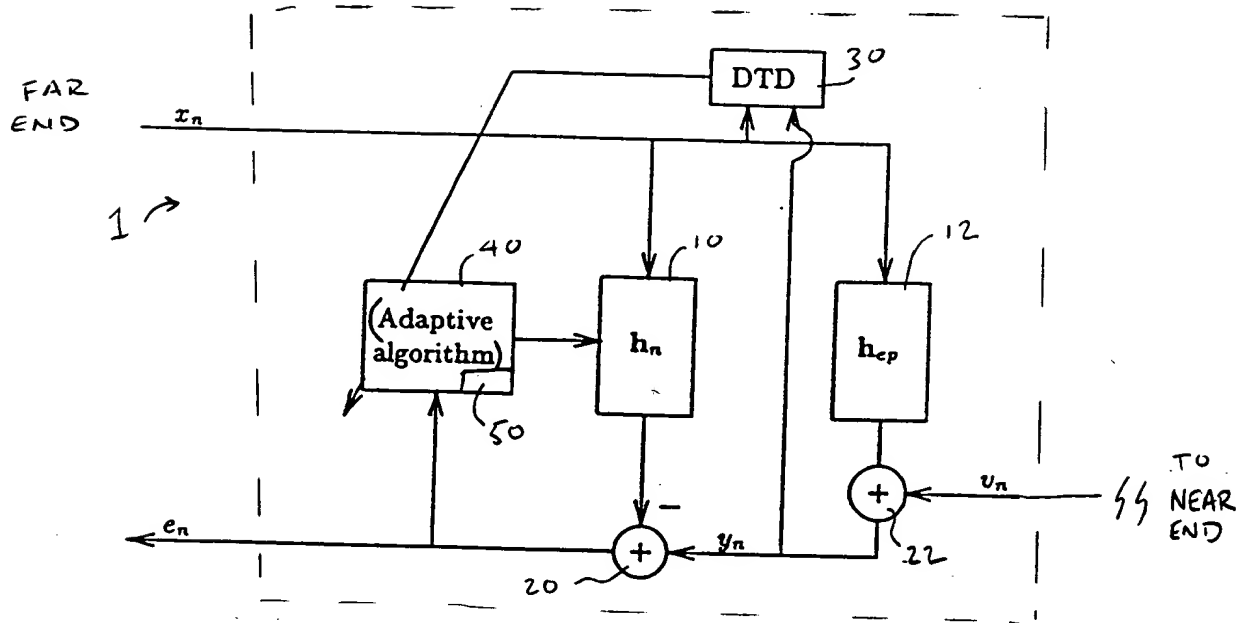


FIG. 3

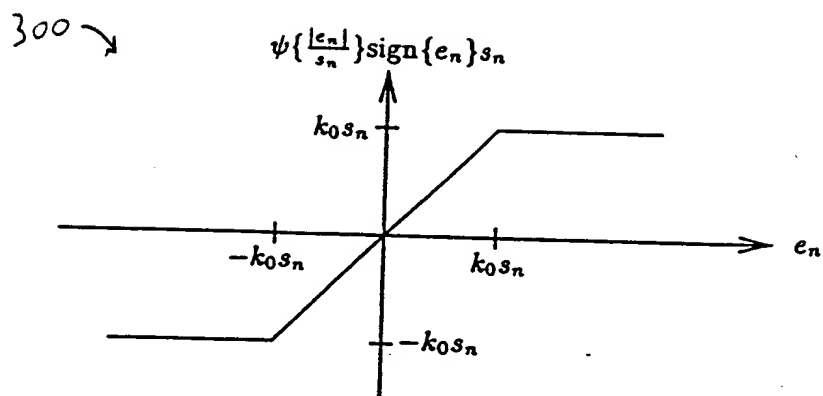


FIG. 4

Figure 3: (a) Impulse response and (b) magnitude of the frequency response of the hybrid.

Figure 10 consists of three vertically stacked plots labeled (a), (b), and (c). Plot (a) shows a time series of misalignment in dB over 12 seconds. The signal is highly noisy, fluctuating between approximately -20 dB and 0 dB. Plot (b) shows the same misalignment data as in (a), but with a smoother, dashed line overlaid. The dashed line follows the general trend of the noisy signal, showing three distinct peaks around 3.5, 6.5, and 9.5 seconds. Plot (c) shows the misalignment data with a solid line and a dashed line. The solid line is the same as in (b). The dashed line is a smoothed version of the solid line. At the bottom of plot (c), there is a 'DTD indicator' with three vertical bars corresponding to the peaks in the misalignment signal. The x-axis for all plots is 'seconds' from 0 to 12. The y-axis for all plots is 'Misalignment, dB' from -60 to 20.

FIG. 7

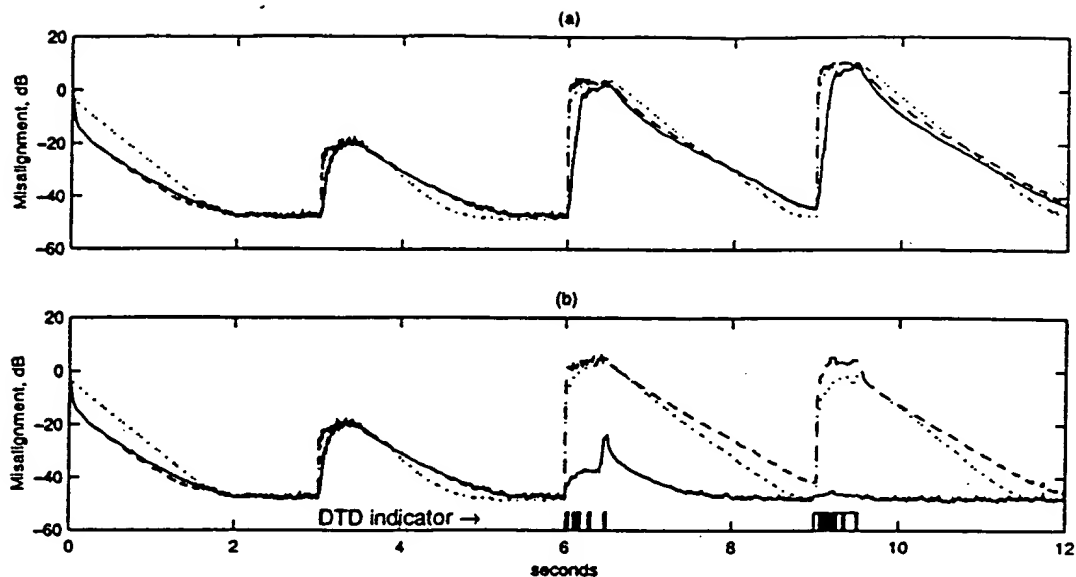


Figure 5: Performance during double-talk for parameter setting $\lambda = 0.995$, $k_0 = 1.5$. Far- to near-end ratio: 30 dB (3 – 3.5 s), 6 dB (6 – 6.5 s), 0 dB (9 – 9.5 s). (a) Misalignment without double-talk detector. (b) Misalignment with double-talk detector. Solid line: R-PNLMS++, Dashed line: PNLMS++, Dotted line: NLMS. The small vertical bars indicate when double-talk is declared.

FIG. 8

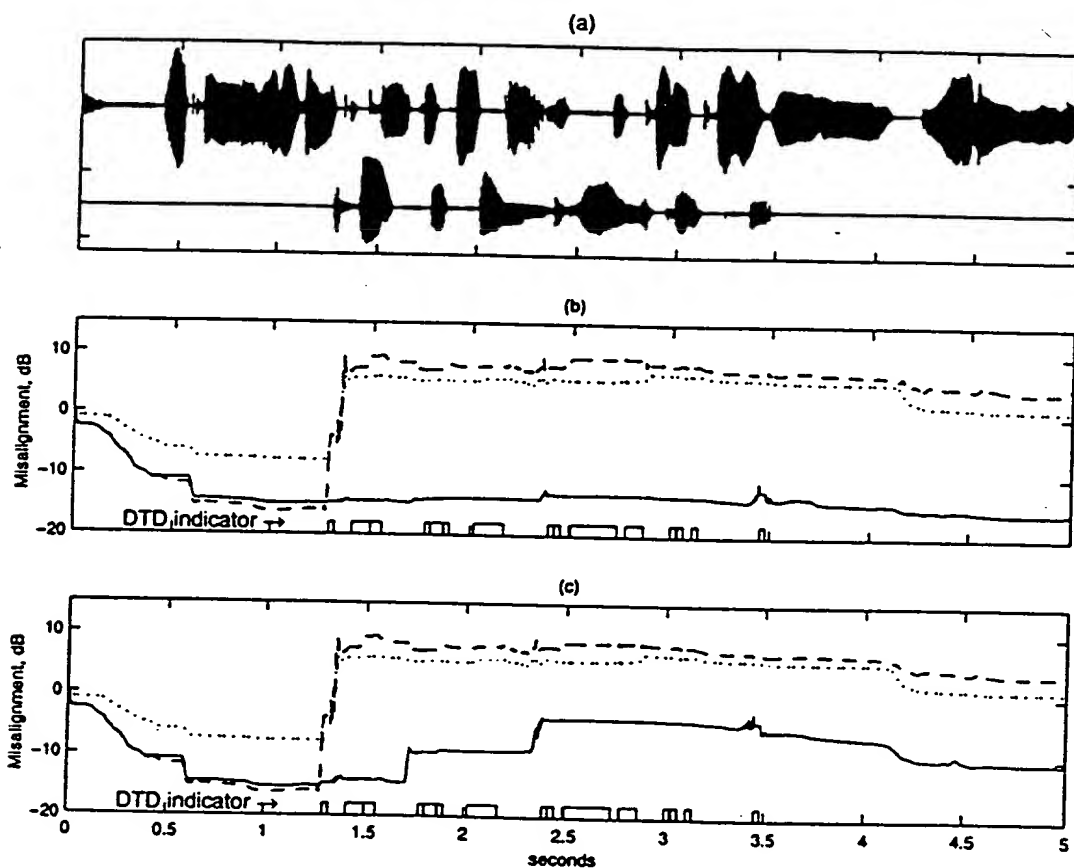


Figure 6: Double-talk, speech signal. (a) Far- and near-end signals. Average far- to near-end ratio: 6 dB (1.125-3.125 s). (b) Misalignment, $\lambda = 0.997$, $k_0 = 1.1$. (c) Misalignment, $\lambda = 0.995$, $k_0 = 1.5$. Solid line: R-PNLMS++, Dashed line: PNLMS++, Dotted line: NLMS.

FIG. 9

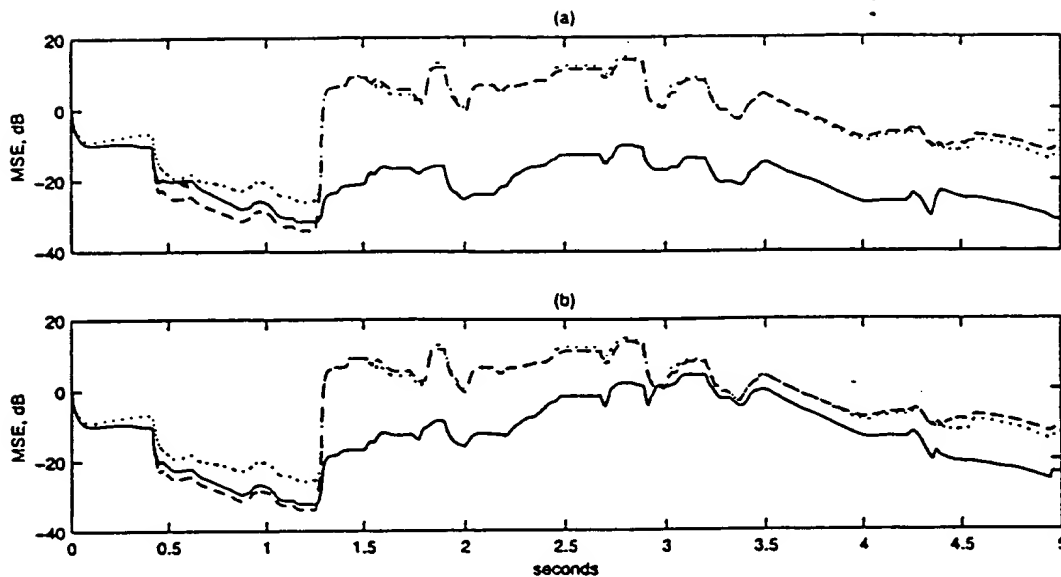


Figure 7: Double-talk, speech signal as in Fig. 6a. (a) shows MSE when $\lambda = 0.997$, $k_0 = 1.1$. (b) shows MSE when $\lambda = 0.995$, $k_0 = 1.5$. Solid line: R-PNLMS++, Dashed line: PNLMS++, Dotted line: NLMS.

FIG. 10

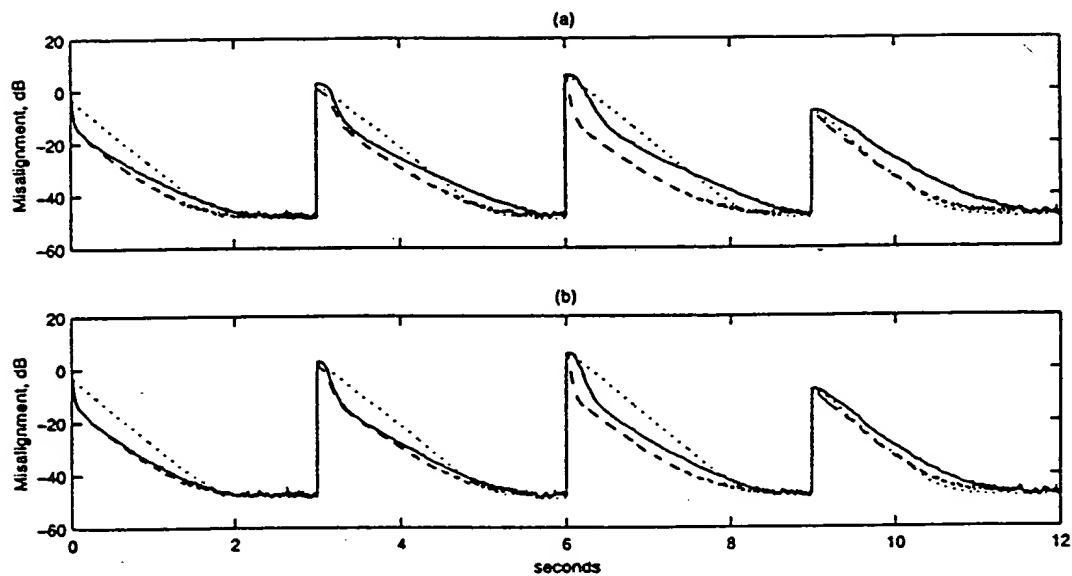


Figure 8: Reconvergence after abrupt hybrid changes. Case A at 3 s, Case B at 6 s and Case C at 9 s. (See Section 4.2.2 for a definition the three conditions). (a) $\lambda = 0.997$, $k_0 = 1.1$ (b) $\lambda = 0.995$, $k_0 = 1.5$. Solid line: R-PNLMS++, Dashed line: PNLMS++, Dotted line: NLMS.

FIG. 11

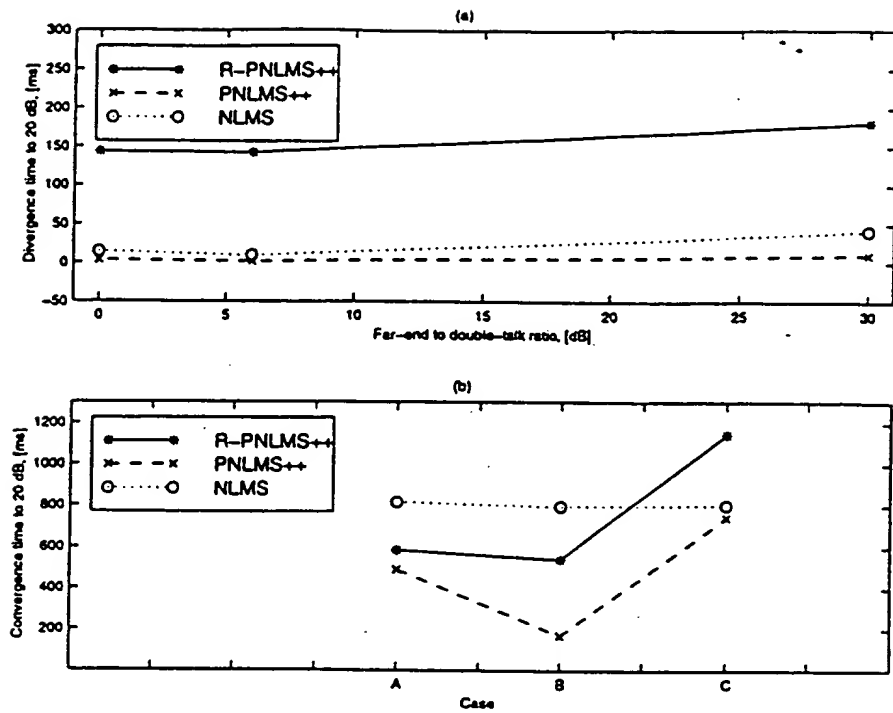


Figure 9: Divergence (a) and convergence (b) time to 20 dB change of misalignment. $\lambda = 0.997$, $k_0 = 1.1$. Solid line: R-PNLMS++, Dashed line: PNLMS++, Dotted line: NLMS.

FIG. 12

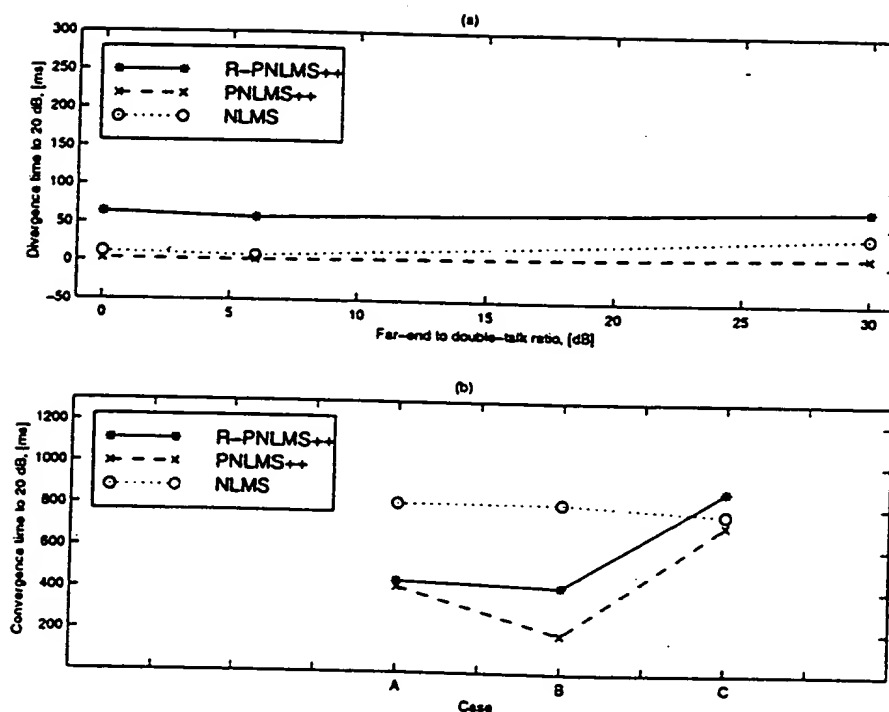


Figure 10: Divergence (a) and convergence (b) time to 20 dB change of misalignment. $\lambda = 0.995$, $k_0 = 1.5$. Solid line: R-PNLMS++, Dashed line: PNLMS++, Dotted line: NLMS.

FIG. 13

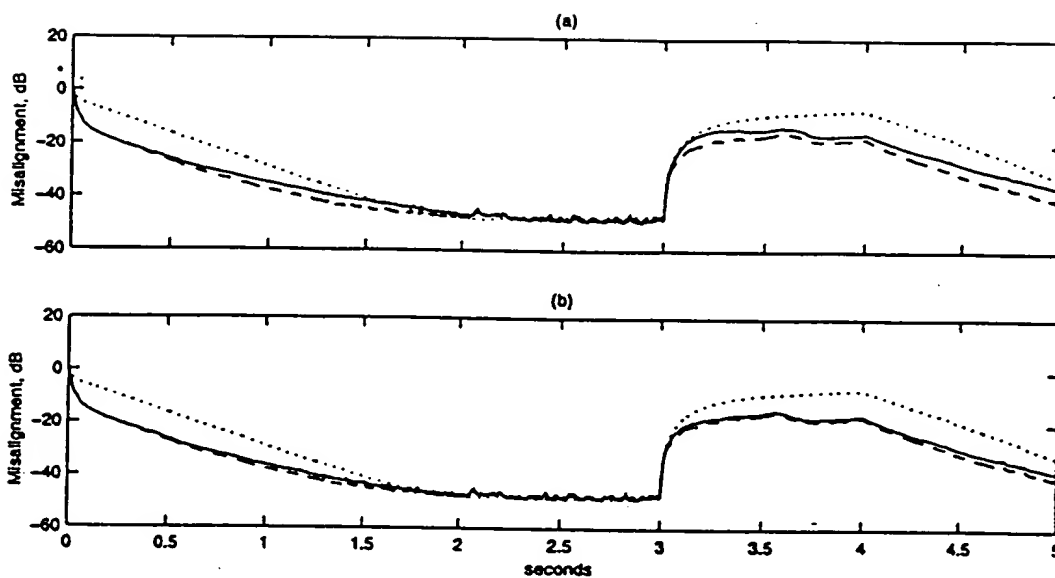


Figure 11: Misalignment when tracking a nonstationary hybrid, 3 - 4 s. (a) $\lambda = 0.997$, $k_0 = 1.1$. (b) $\lambda = 0.995$, $k_0 = 1.5$. Solid line: R-PNLMS++, Dashed line: PNLMS++, Dotted line: NLMS.

FIG. 14

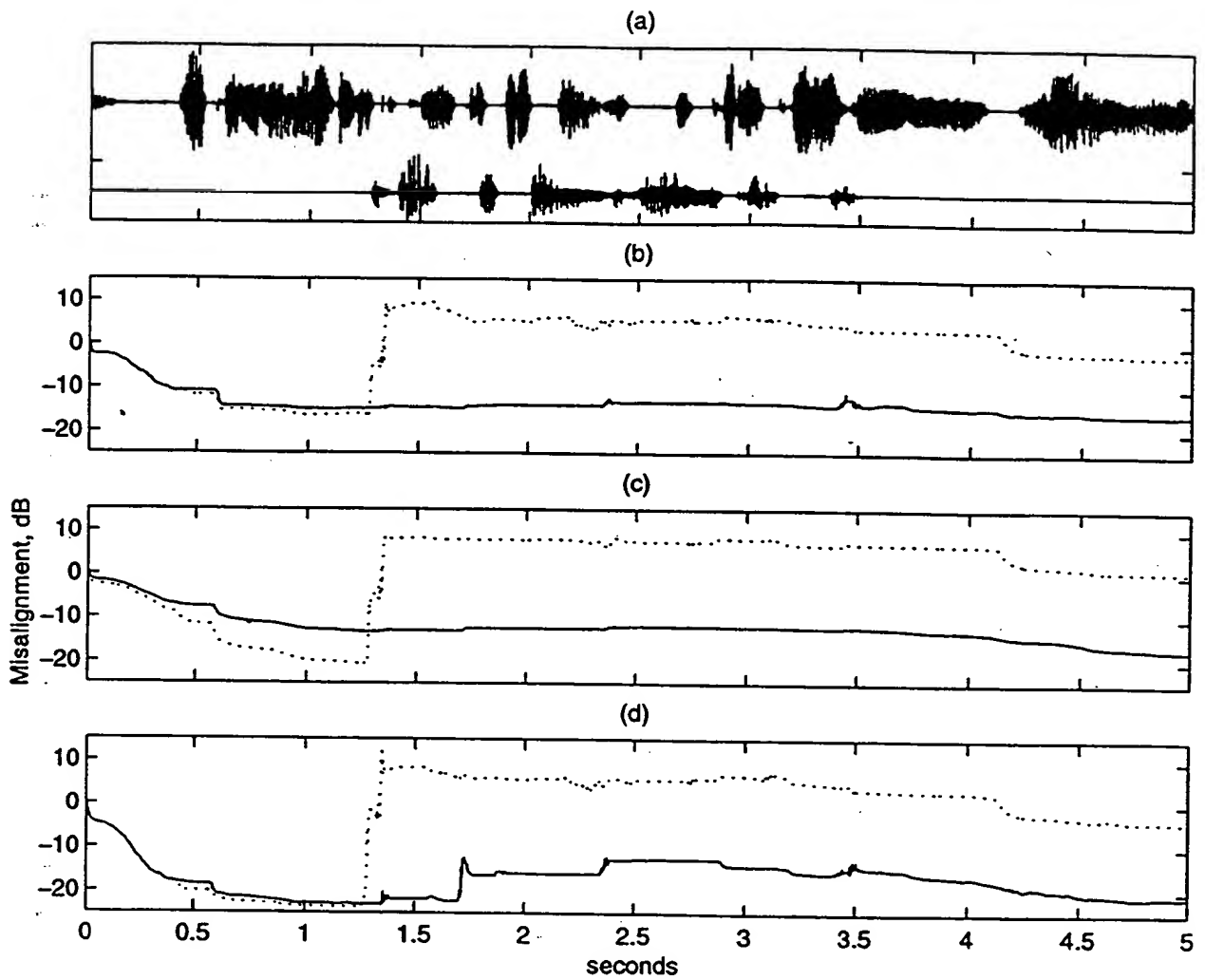


Figure 4: Misalignment during double-talk starting at 1.25 seconds. Far- to near-end ratio: 6 dB. (a) Far (upper) and near-end (lower) signals. (b) Solid line: R-PNLMS++, Dotted line: PNLMS++. (c) Solid line: R-APA, Dotted line: APA. (d) Solid line: R-PAPA, Dotted line: PAPA.

FIG. 15

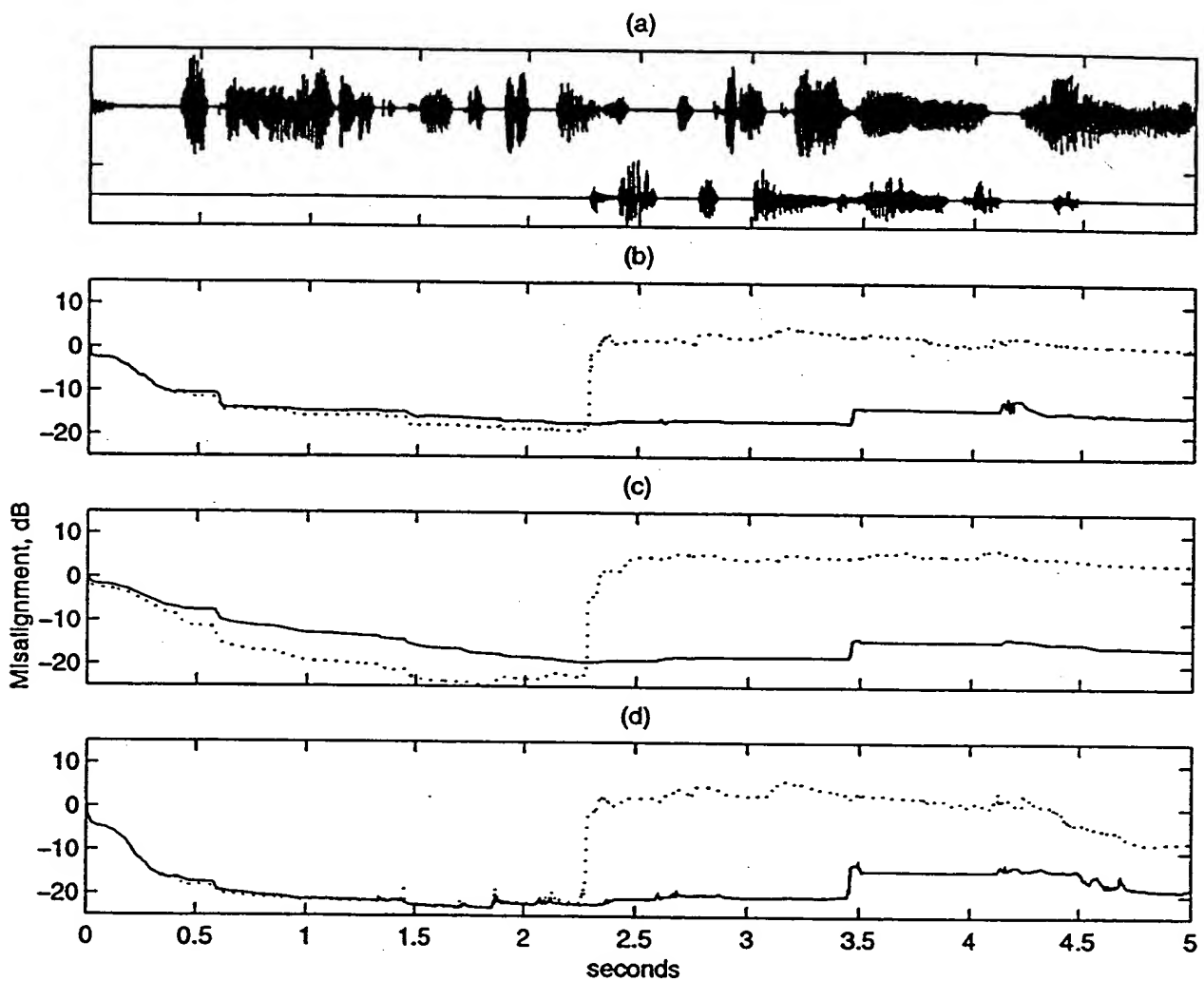


Figure 5: Misalignment during double-talk starting at 2.25 seconds. Far- to near-end ratio: 6 dB. (a) Far (upper) and near-end (lower) signals. (b) Solid line: R-PNLMS++, Dotted line: PNLMS++. (c) Solid line: R-APA, Dotted line: APA. (d) Solid line: R-PAPA, Dotted line: PAPA.

FIG. 16

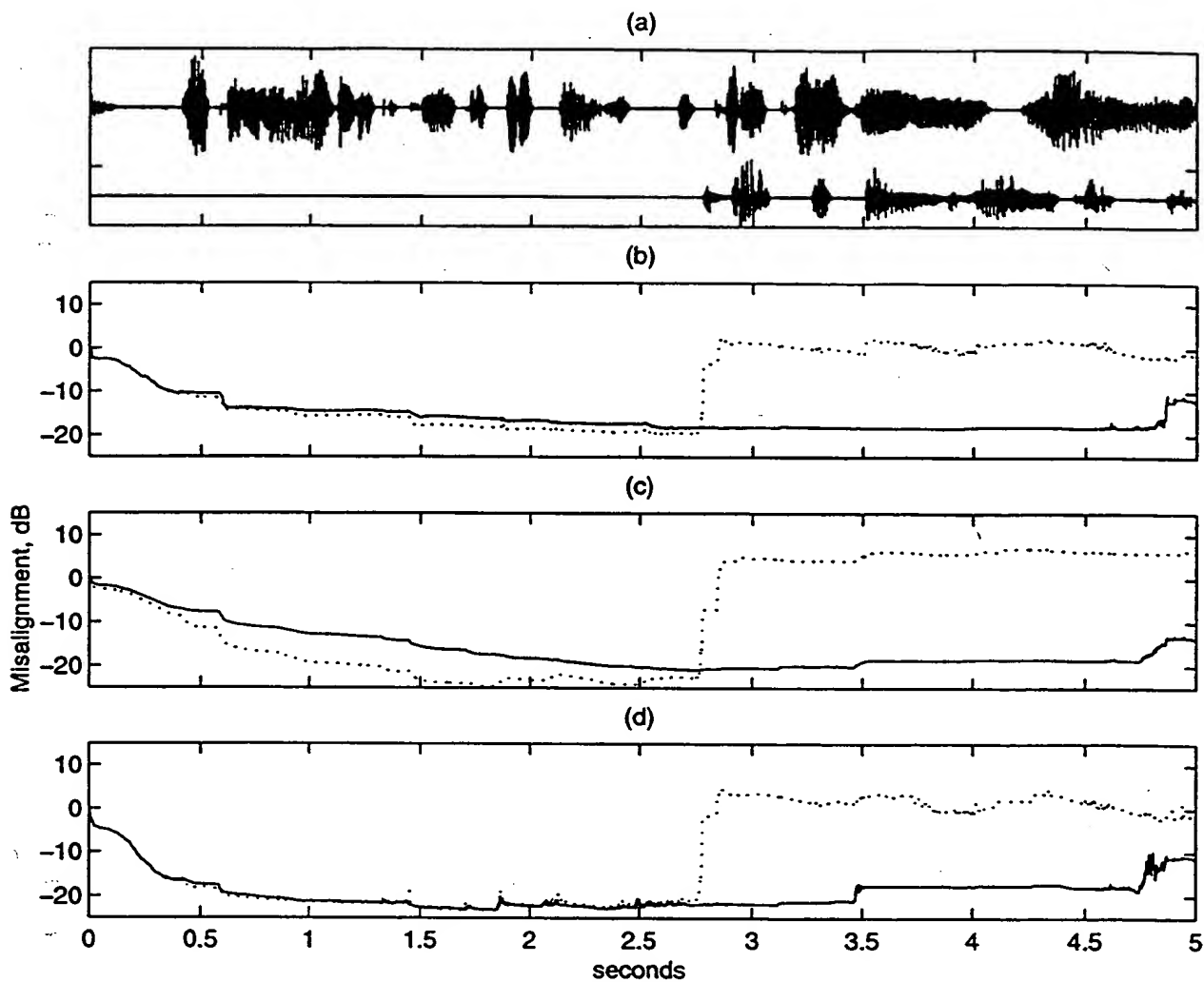


Figure 6: Misalignment during double-talk starting at 2.75 seconds. Far- to near-end ratio: 6 dB. (a) Far (upper) and near-end (lower) signals. (b) Solid line: R-PNLMS++, Dotted line: PNLMS++. (c) Solid line: R-APA, Dotted line: APA. (d) Solid line: R-PAPA, Dotted line: PAPA.

FIG. 17

FIG. 18

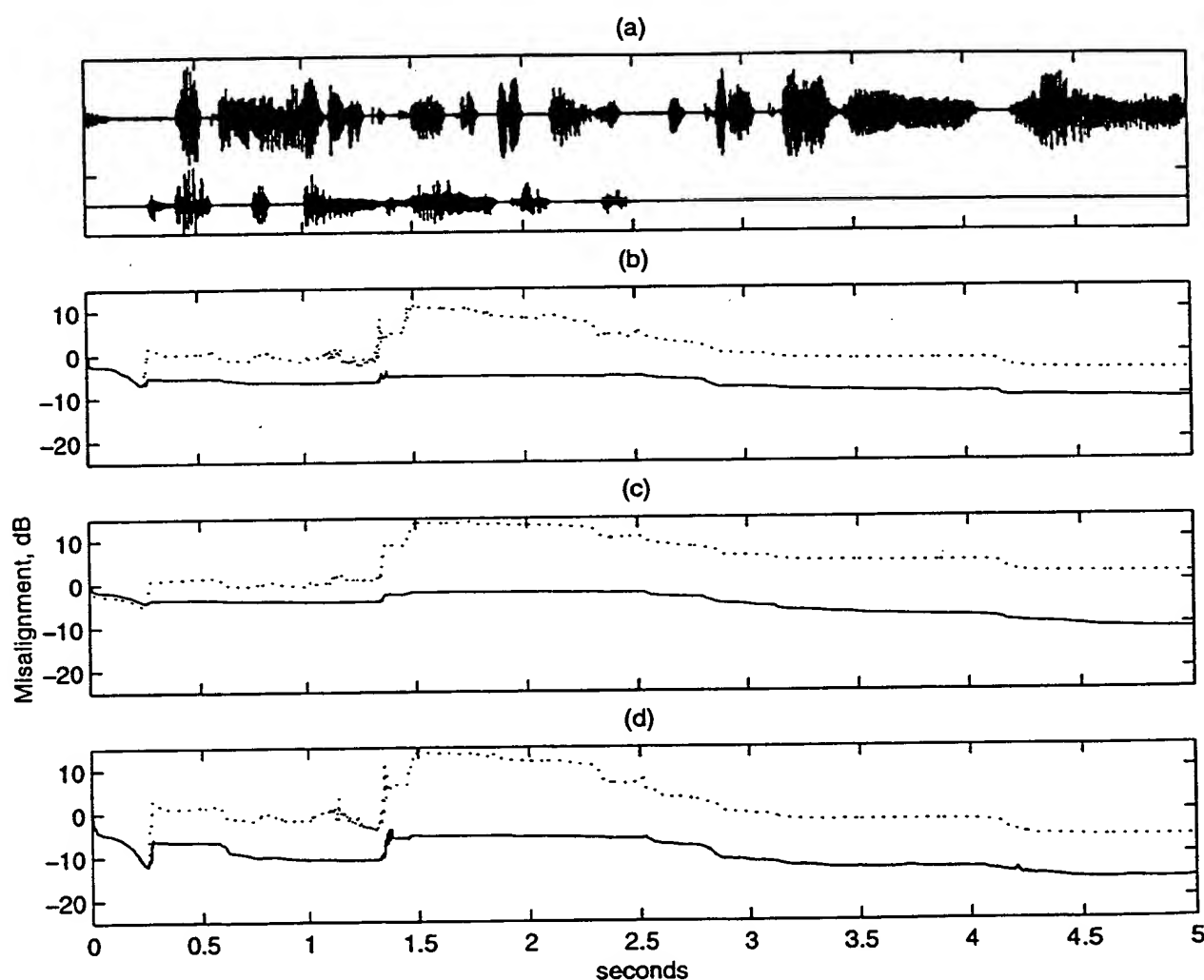


Figure 7: Misalignment during double-talk starting at 0.25 seconds. Far- to near-end ratio: 6 dB. (a) Far (upper) and near-end (lower) signals. (b) Solid line: R-PNLMS++, Dotted line: PNLMS++. (c) Solid line: R-APA, Dotted line: APA. (d) Solid line: R-PAPA, Dotted line: PAPA.

FIG. 19

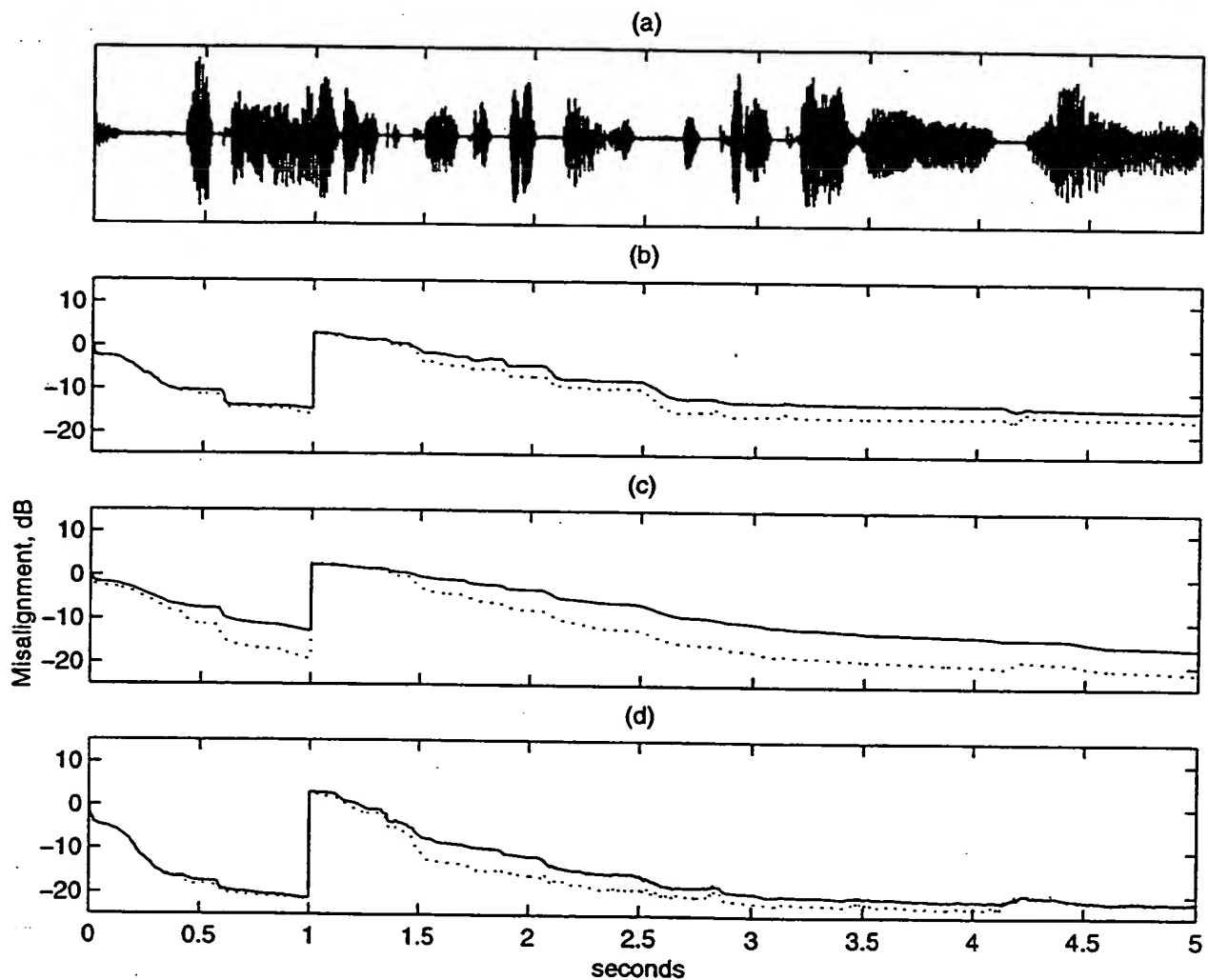


Figure 8: Misalignment after abrupt hybrid change occurring at 1 second. (a) Far (upper) and near-end (lower) signals. (b) Solid line: R-PNLMS++, Dotted line: PNLMS++. (c) Solid line: R-APA, Dotted line: APA. (d) Solid line: R-PAPA, Dotted line: PAPA.

FIG. 20

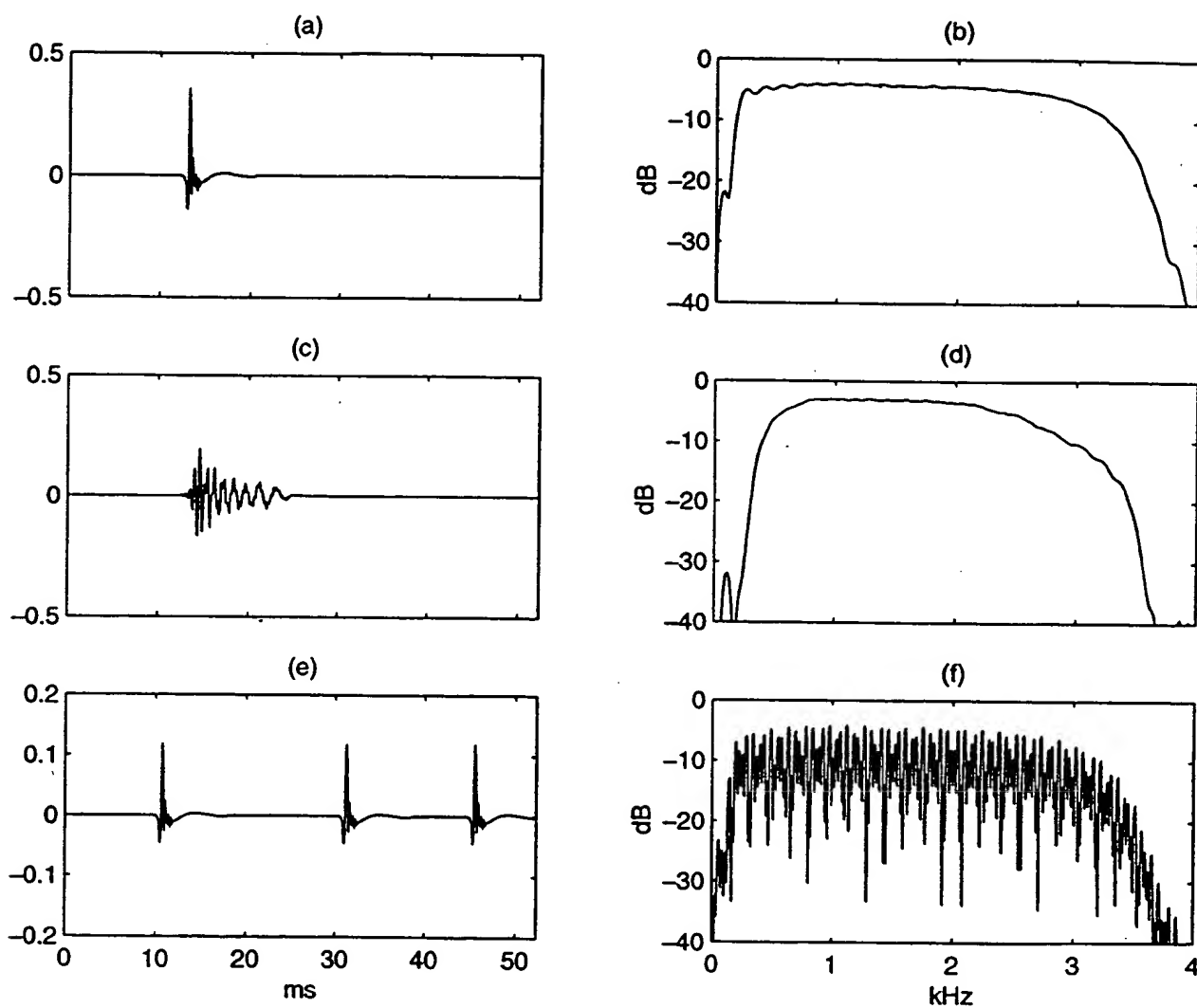


Figure 9: The three hybrids is Test 3a and Test 3b. (a, c, e) Impulse responses. (b, d, f) Corresponding magnitudes of the frequency responses.

The figure consists of three vertically stacked plots, labeled (a), (b), and (c), each showing a time series over a 10-second interval. The x-axis for all plots is labeled 'seconds' and ranges from 0 to 10, with major ticks at 0, 2, 4, 6, 8, and 10. The y-axis for each plot has three unlabeled tick marks above and below the zero line.

- Plot (a):** Shows a signal with high-frequency, high-amplitude oscillations. The signal starts with a small initial transient and then settles into a dense, noisy pattern with large peaks and troughs.
- Plot (b):** Shows a signal with moderate-frequency, moderate-amplitude oscillations. The signal is less dense than (a) but still exhibits significant fluctuations.
- Plot (c):** Shows a signal with low-frequency, low-amplitude oscillations. The signal appears as a series of small, slow-moving fluctuations around the zero line.

Figure 10: Signal for Test 3a. (a) Far-end signal. (b) Echo and near-end signal. (c) Near-end signal.

FIG. 21

FIG. 22

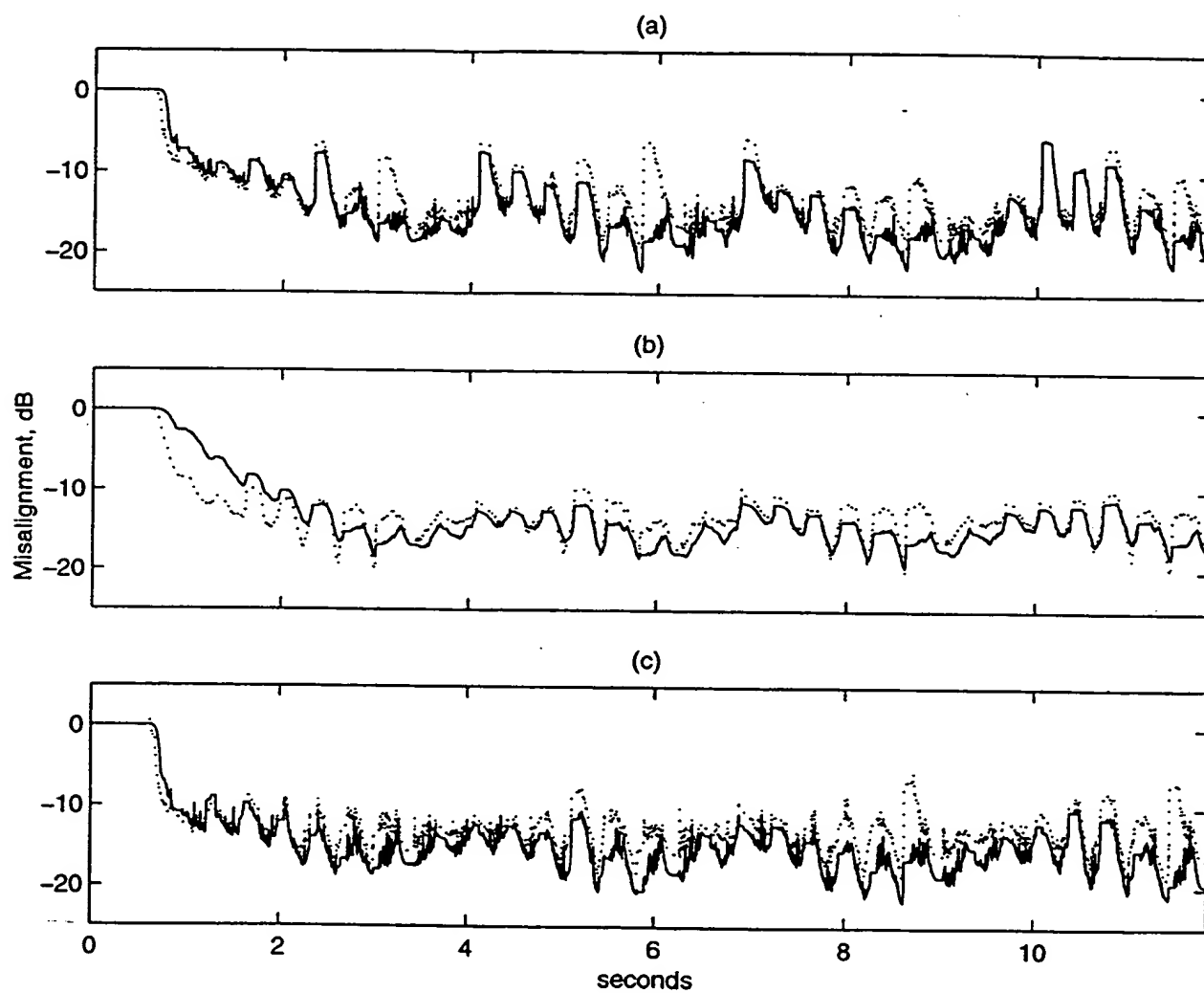


Figure 11: Misalignment Test 3a, hybrid in Fig. 9a (sparse) with 8 dB attenuation. (a) Solid line: Robust PNLMS++, dashed line: PNLMS++. (b) Solid line: Robust APA, dashed line: APA. (c) Solid line: Robust PAPA, dashed line: PAPA.

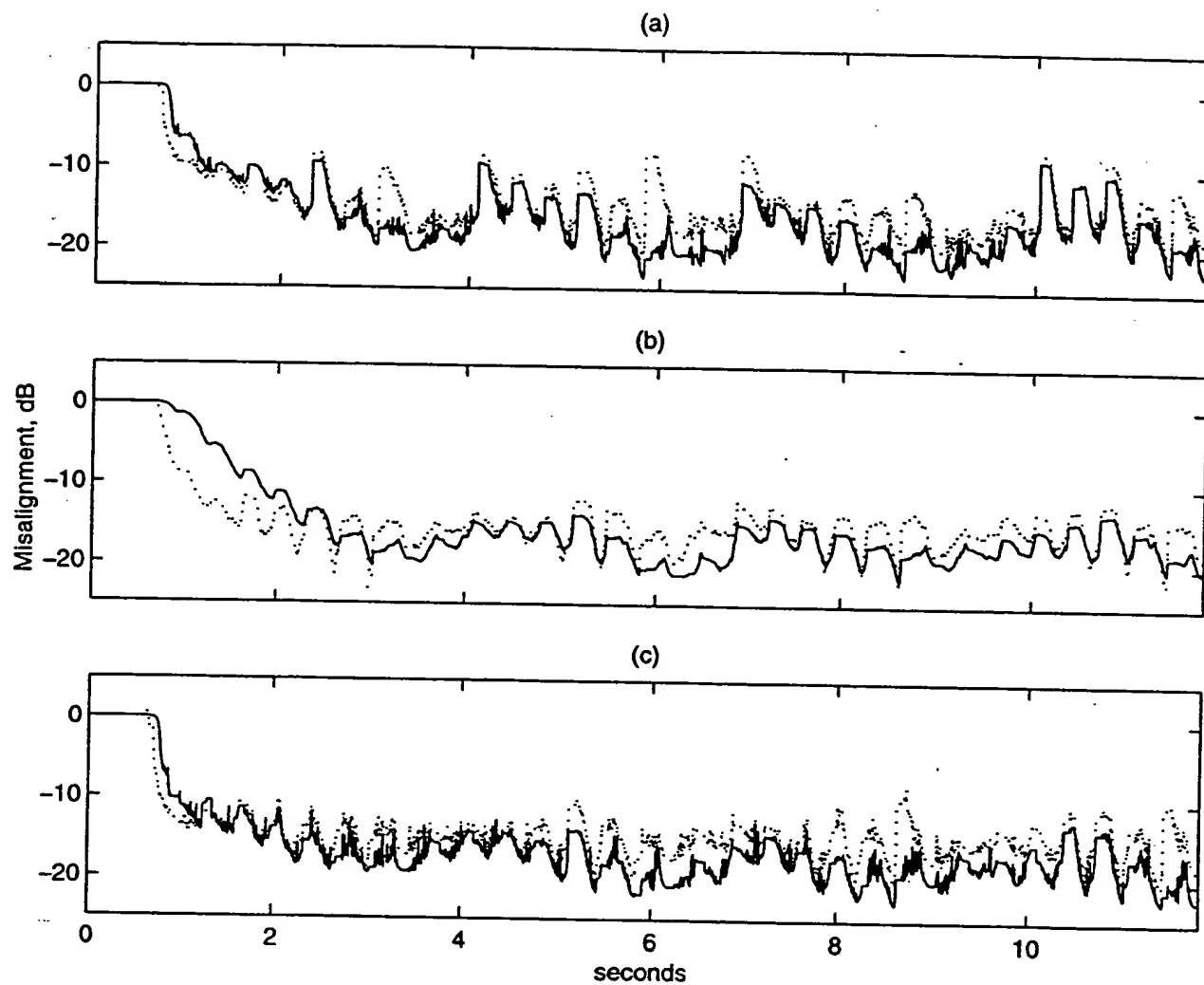


Figure 12: Misalignment Test 3a, hybrid in Fig. 9a (sparse) with 6 dB attenuation. (a) Solid line: Robust PNLMS++, dashed line: PNLMS++. (b) Solid line: Robust APA, dashed line: APA. (c) Solid line: Robust PAPA, dashed line: PAPA.

FIG. 23

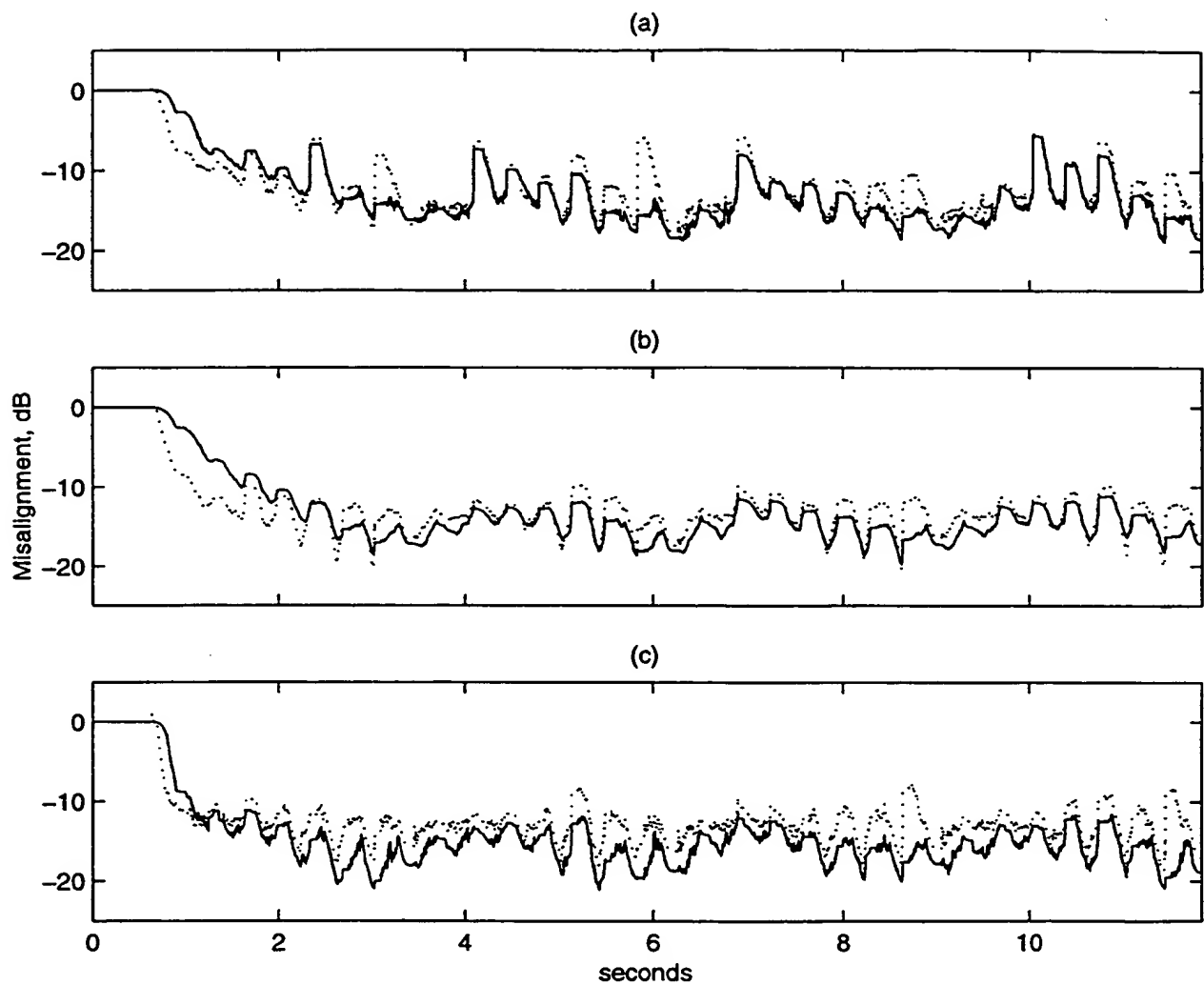


Figure 13: Misalignment Test 3a, hybrid in Fig. 9c (dispersive) with 8 dB attenuation. (a) Solid line: Robust PNLMS++, dashed line: PNLMS++. (b) Solid line: Robust APA, dashed line: APA. (c) Solid line: Robust PAPA, dashed line: PAPA.

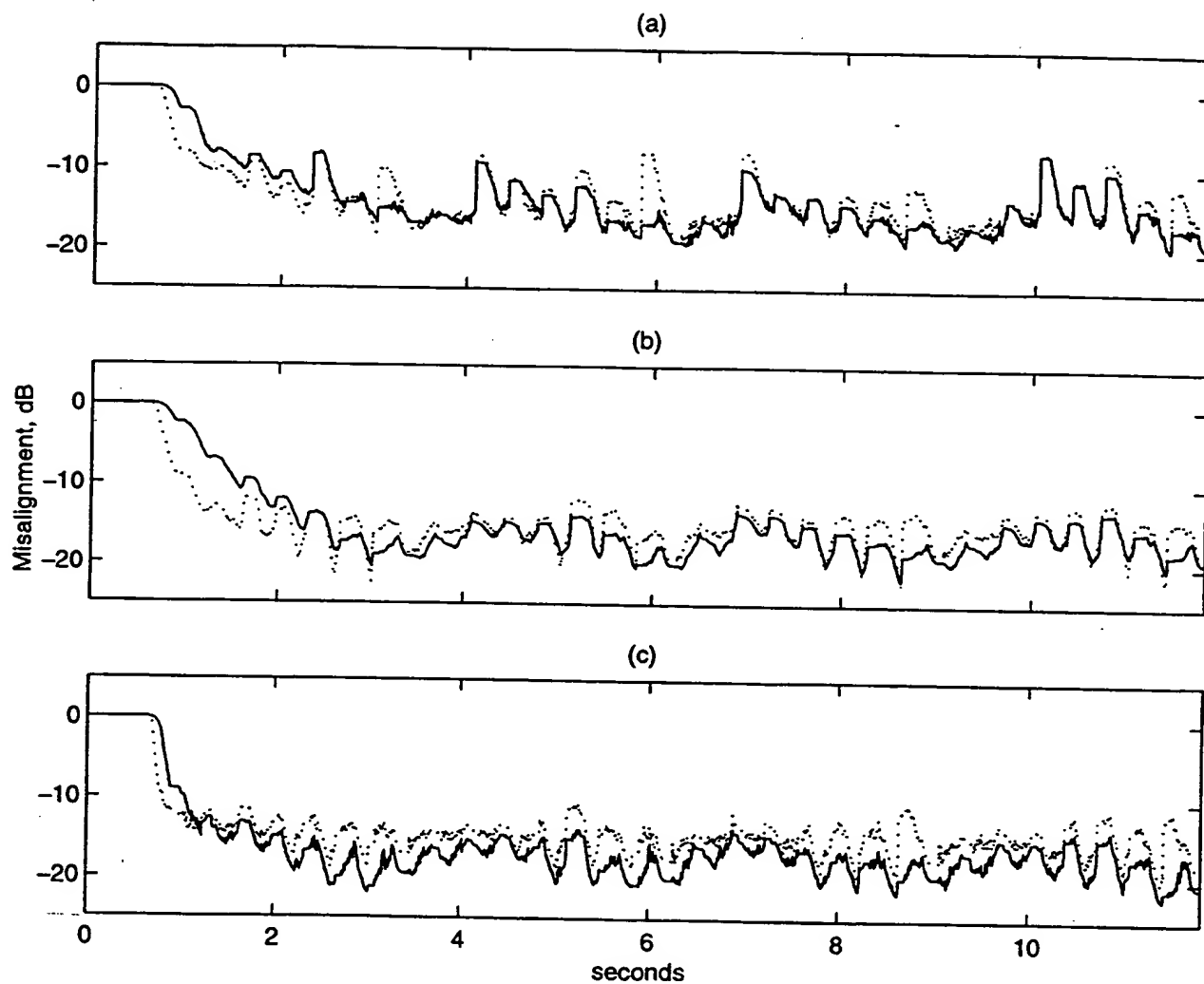


Figure 14: Misalignment Test 3a, hybrid in Fig. 9c (dispersive) with 6 dB attenuation. (a) Solid line: Robust PNLMS++, dashed line: PNLMS++. (b) Solid line: Robust APA, dashed line: APA. (c) Solid line: Robust PAPA, dashed line: PAPA.

FIG. 25

FIG. 26

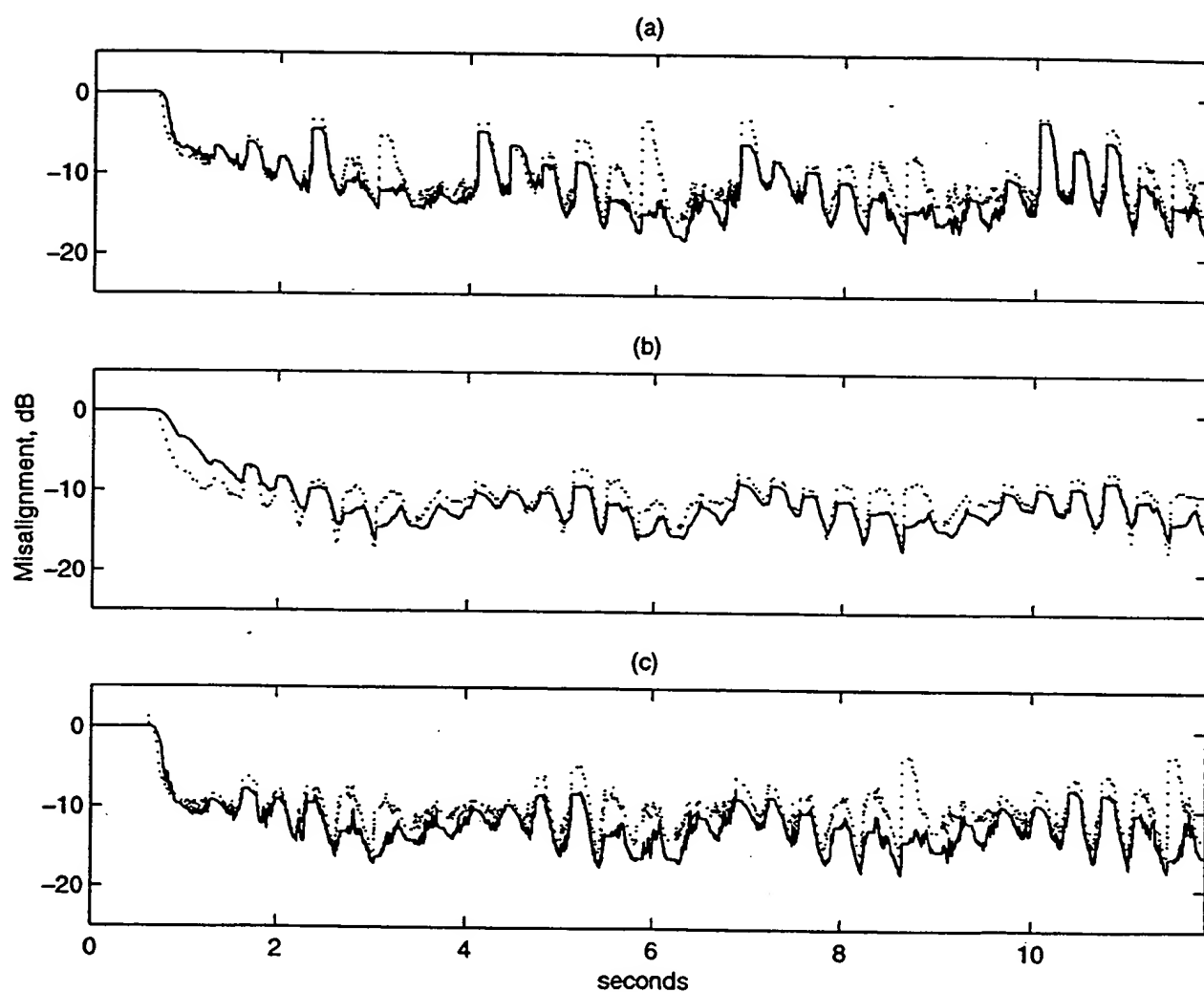


Figure 15: Misalignment Test 3a, hybrid in Fig. 9e (three short reflections) with 11 dB attenuation. (a) Solid line: Robust PNLMS++, dashed line: PNLMS++. (b) Solid line: Robust APA, dashed line: APA. (c) Solid line: Robust PAPA, dashed line: PAPA.

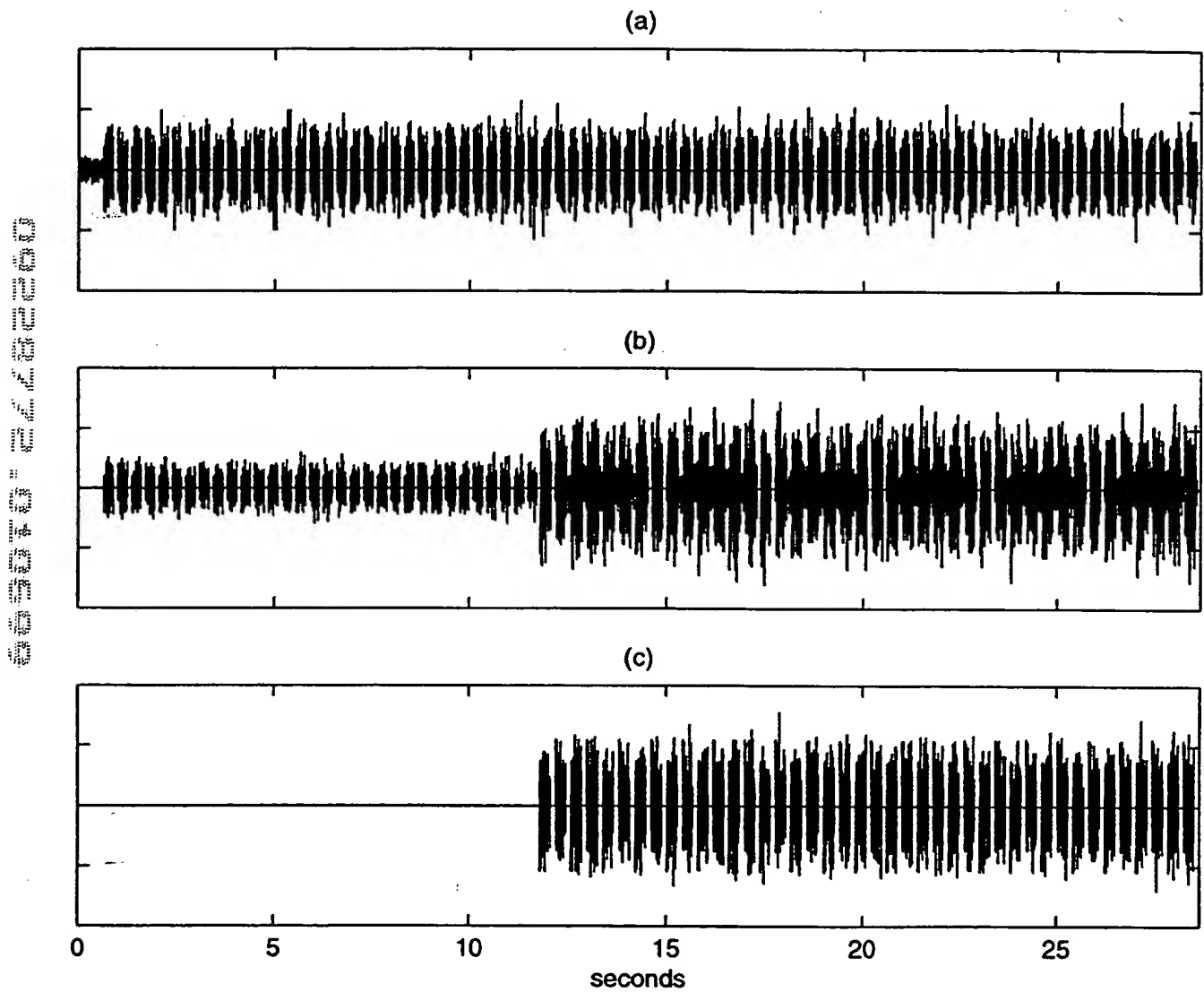


Figure 16: Signal for Test 3b. (a) Far-end signal. (b) Echo and near-end signal. (c) Near-end signal.

FIG. 27

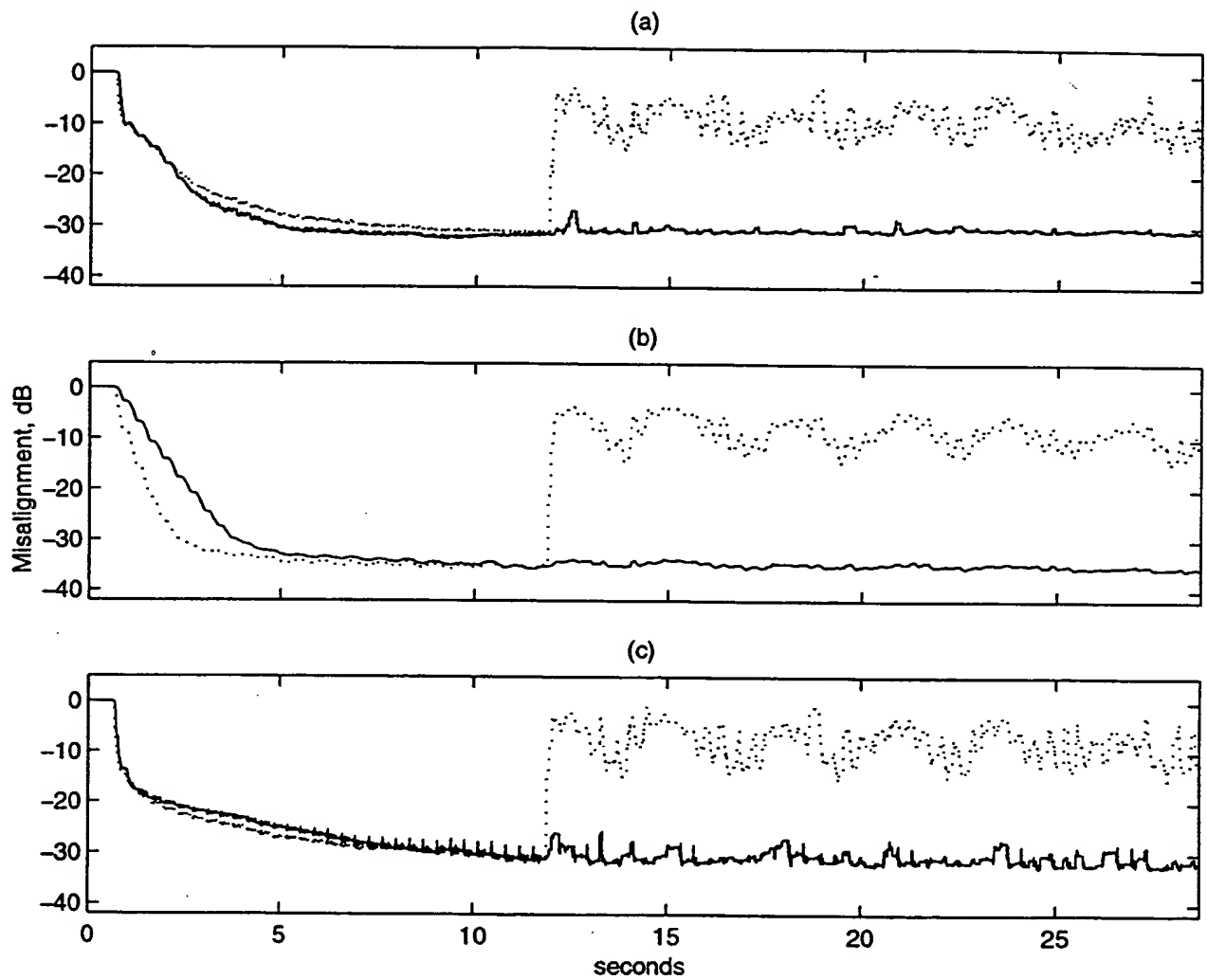


Figure 17: Misalignment Test 3b, hybrid in Fig. 9a (sparse) with 8 dB attenuation. (a) Solid line: Robust PNLMS++, dashed line: PNLMS++. (b) Solid line: Robust APA, dashed line: APA. (c) Solid line: Robust PAPA, dashed line: PAPA.

FIG. 28

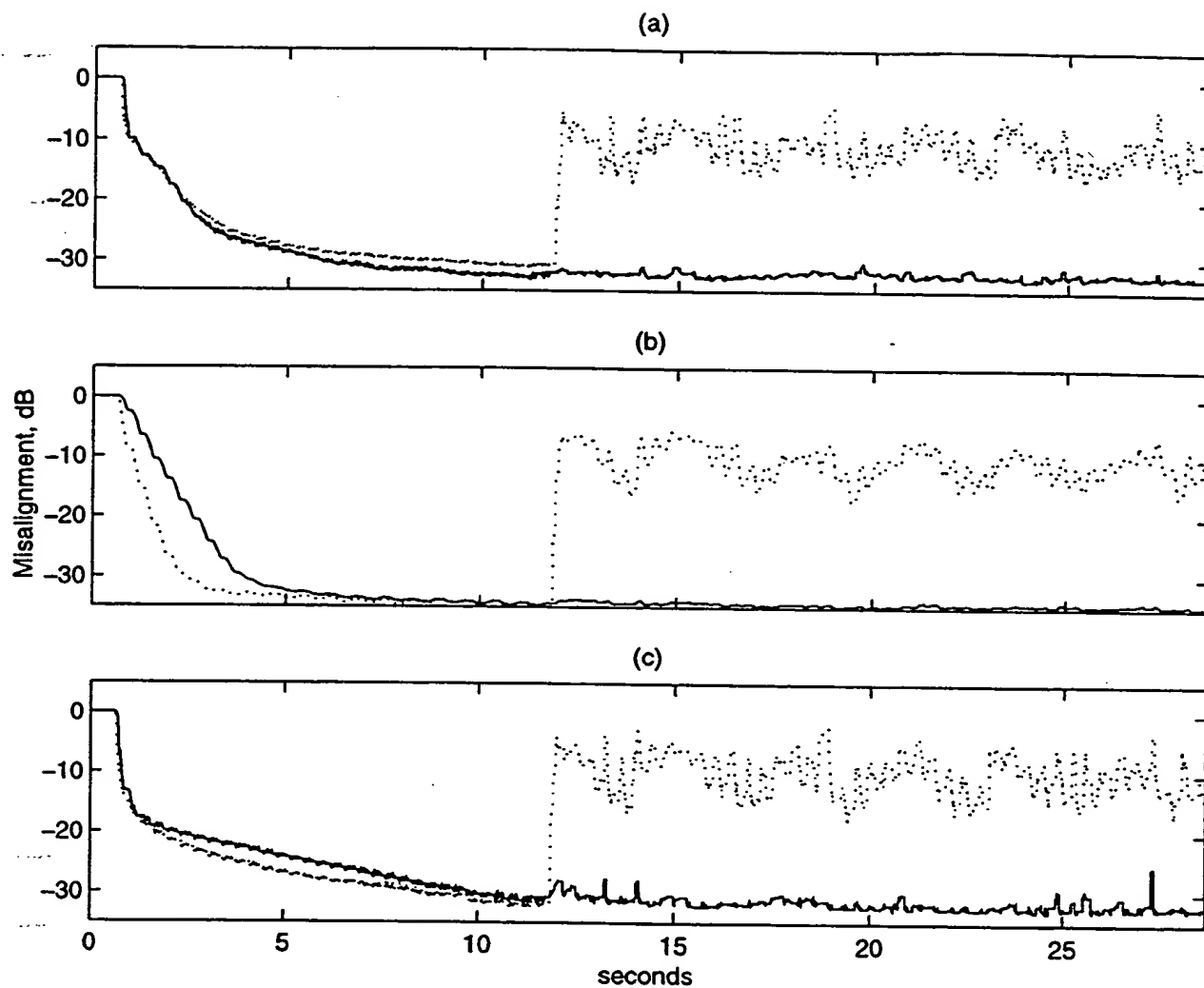


Figure 18: Misalignment Test 3b, hybrid in Fig. 9a (sparse) with 6 dB attenuation. (a) Solid line: Robust PNLMS++, dashed line: PNLMS++. (b) Solid line: Robust APA, dashed line: APA. (c) Solid line: Robust PAPA, dashed line: PAPA.

FIG. 29

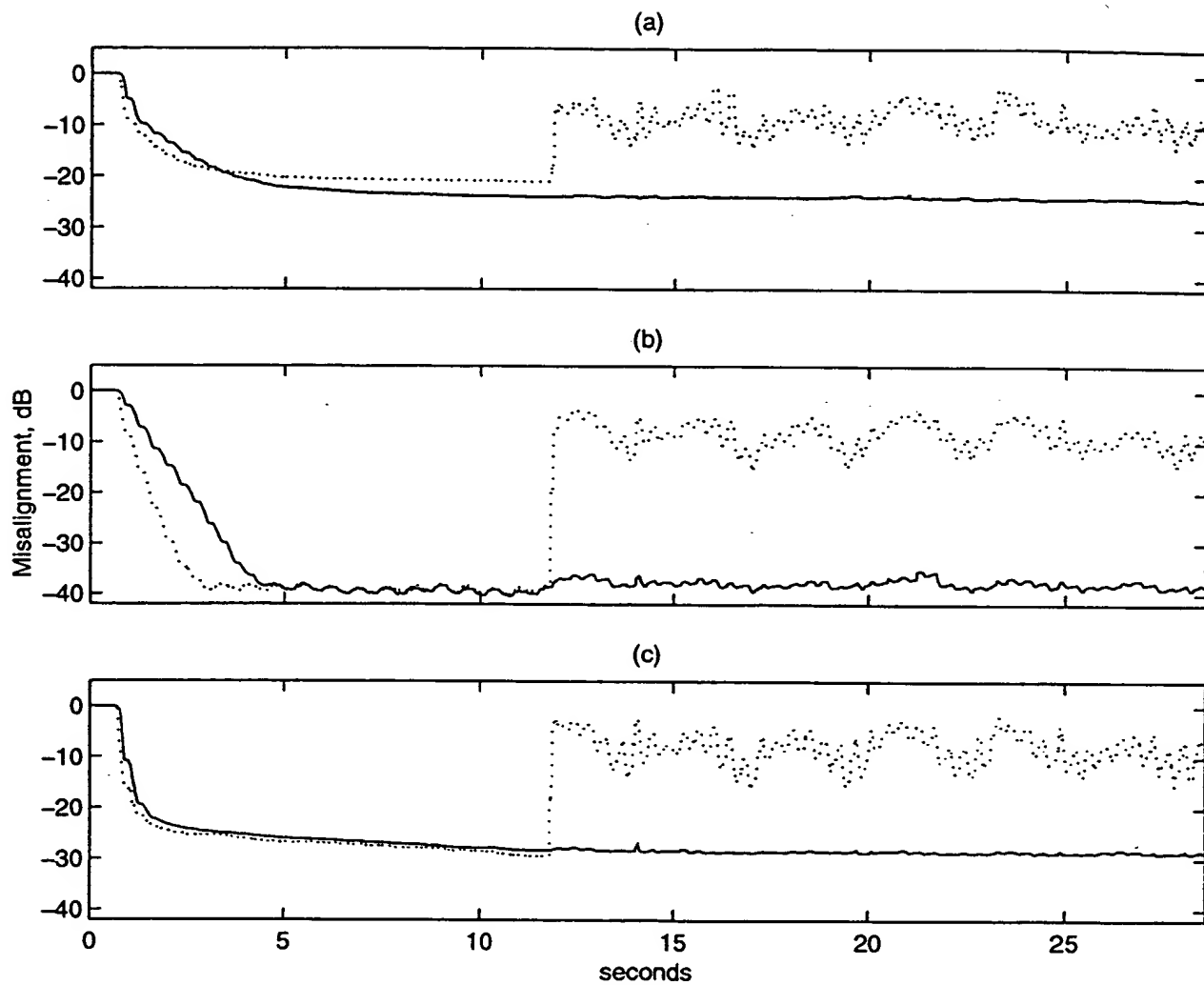


Figure 19: Misalignment Test 3b, hybrid in Fig. 9c (dispersive) with 8 dB attenuation. (a) Solid line: Robust PNLMS++, dashed line: PNLMS++. (b) Solid line: Robust APA, dashed line: APA. (c) Solid line: Robust PAPA, dashed line: PAPA.

FIG. 30

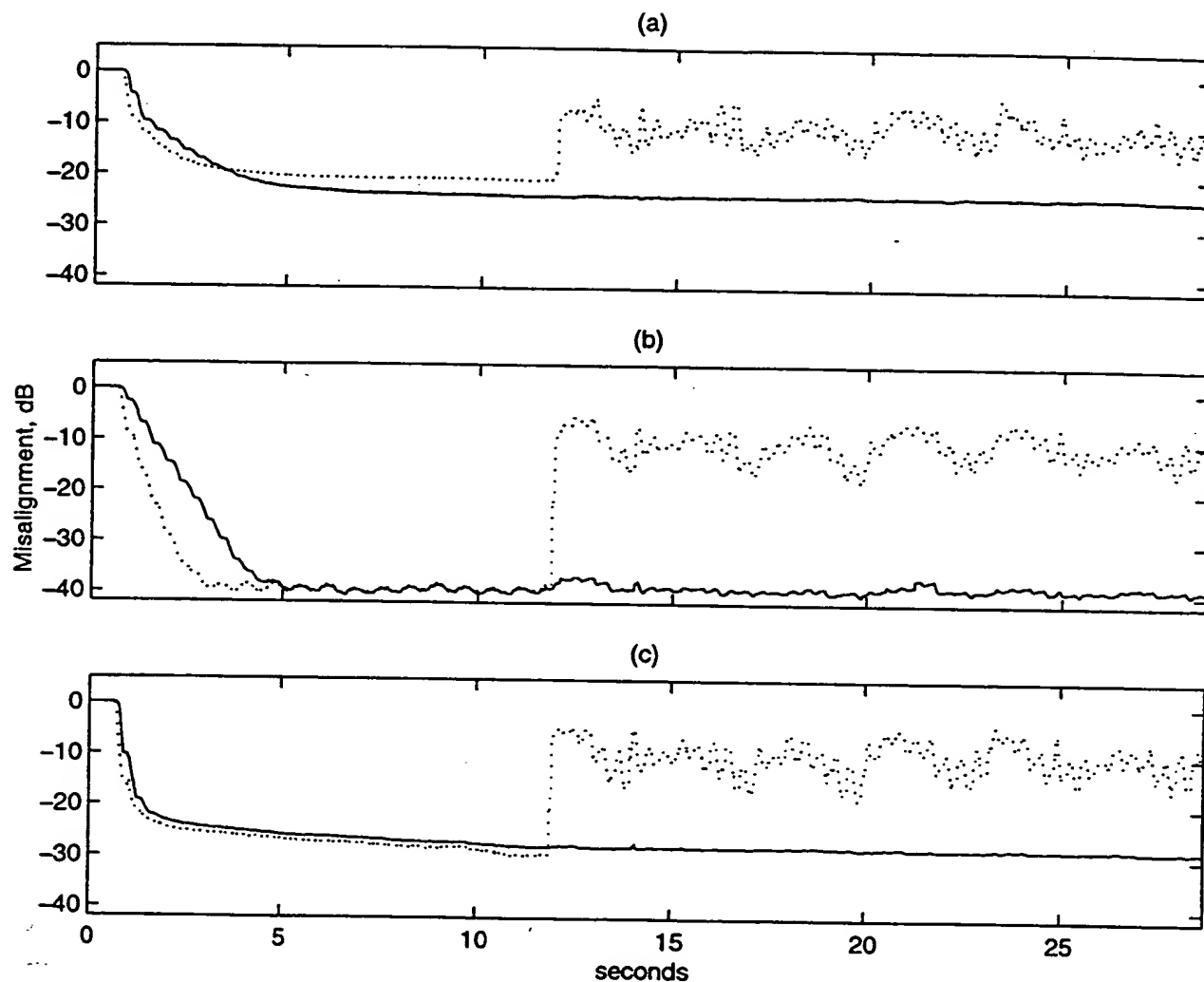


Figure 20: Misalignment Test 3b, hybrid in Fig. 9c (dispersive) with 6 dB attenuation. (a) Solid line: Robust PNLMS++, dashed line: PNLMS++. (b) Solid line: Robust APA, dashed line: APA. (c) Solid line: Robust PAPA, dashed line: PAPA.

FIG. 31

005939 6223260

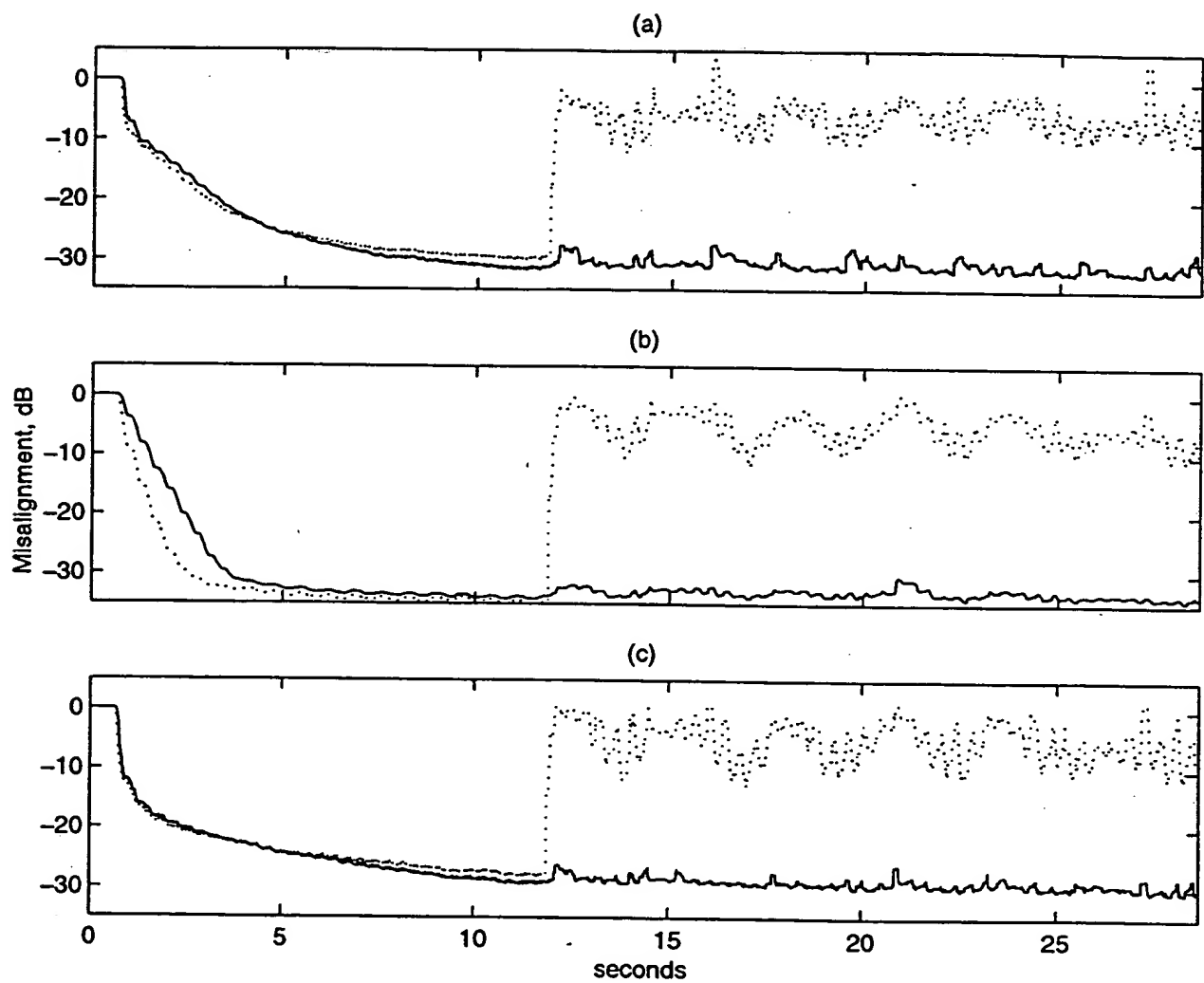


Figure 21: Misalignment Test 3b, hybrid in Fig. 9e (three short reflections) with 11 dB attenuation. (a) Solid line: Robust PNLMS++, dashed line: PNLMS++. (b) Solid line: Robust APA, dashed line: APA. (c) Solid line: Robust PAPA, dashed line: PAPA.

FIG. 32